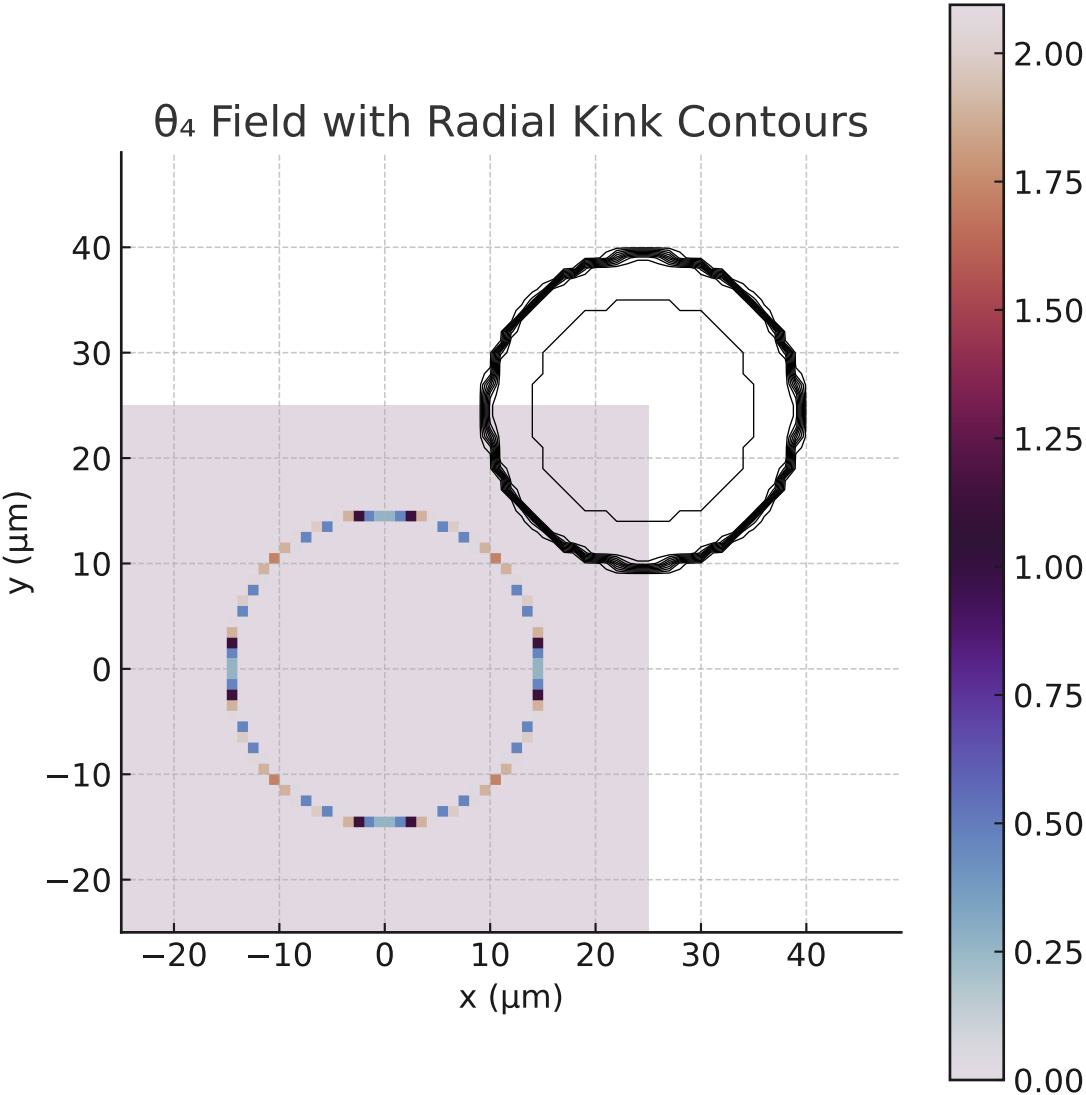
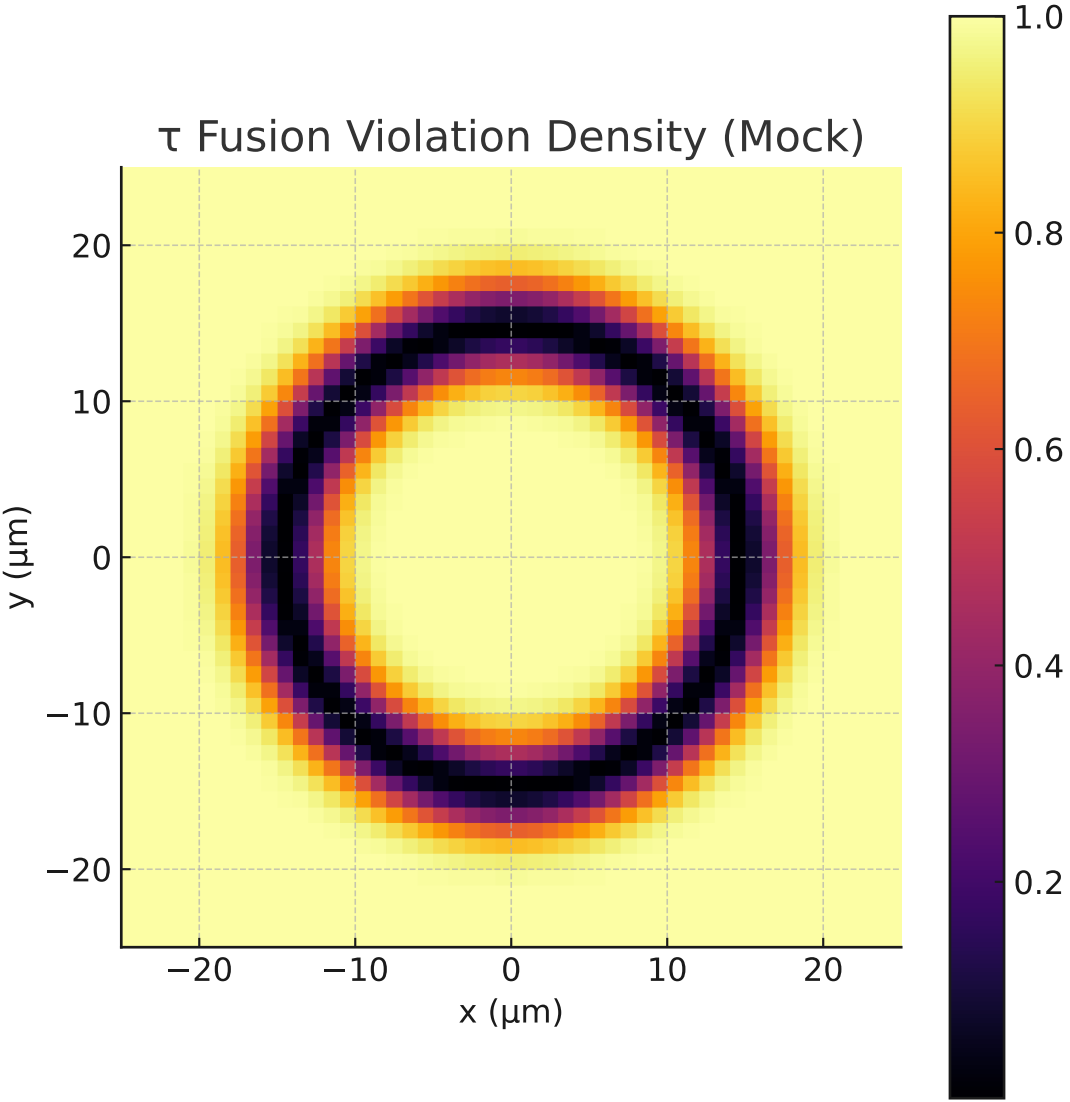
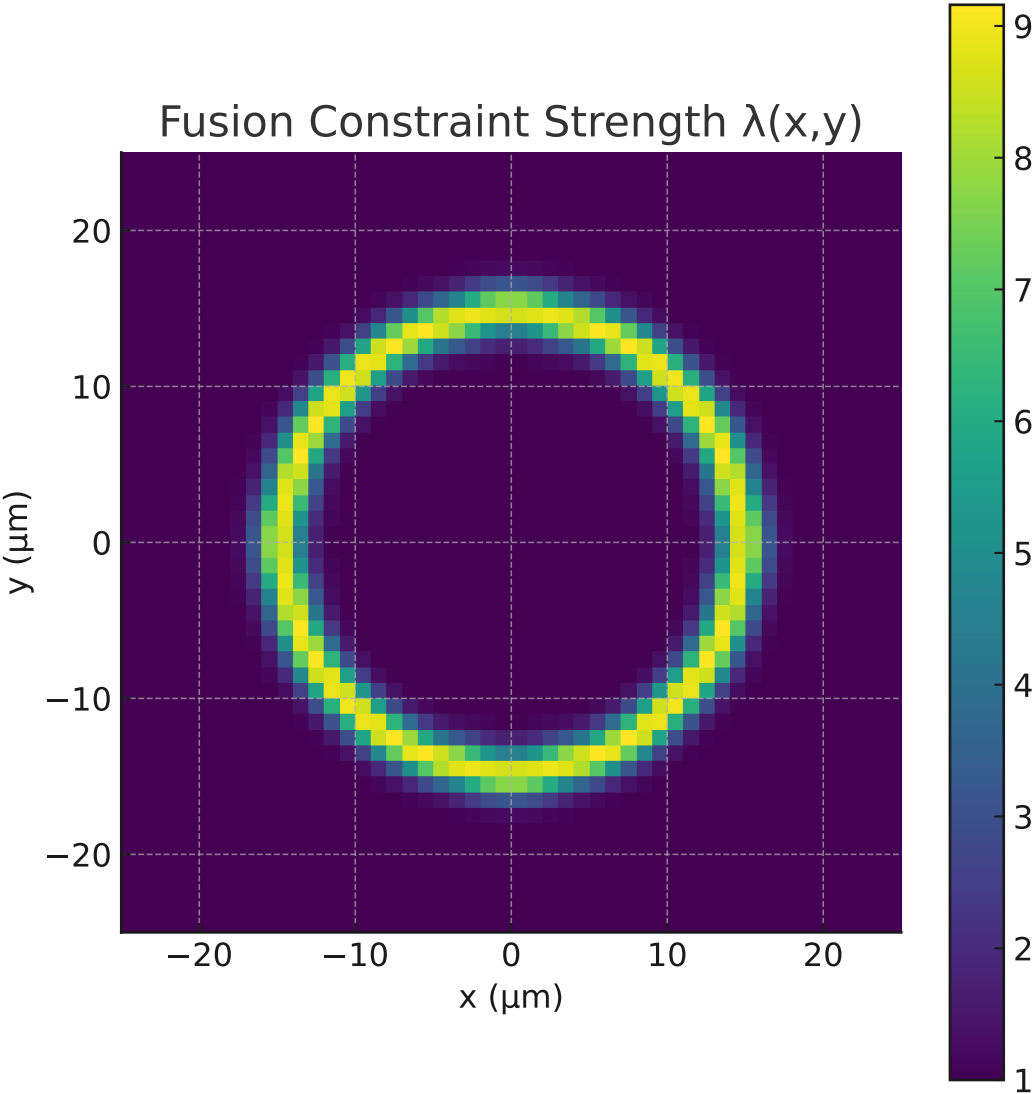

θ₄ Field with Radial Kink Contours
y (μm)
x (μm)
40
30
20
10
0
−10
−20
−20
−10
0
10
20
30
40
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00


τ Fusion Violation Density (Mock)
20
10
0
−10
−20
y (μm)
−20
−10
0
10
20
x (μm)
1.0
0.8
0.6
0.4
0.2


Fusion Constraint Strength λ(x,y)
y (μm)
x (μm)
20
10
0
−10
−20
−20
−10
0
10
20
9
8
7
6
5
4
3
2
1

SAT LAB 1 – Composite Binding Simulation (Radial θ_4–τ Coupling)

Setup:
- 50×50 hexagonal grid with $\tau \in \mathbb{Z}_3$ field and radial $\theta_4(x, y)$ kink.
- $\theta_4(r) = (2\pi/3)(1 + \tanh[\mu(r - r_0)])/2$, with $\mu = 5\ \mu m^{-1}$ and $r_0 = 15\ \mu m$.
- Fusion penalty $\lambda(x, y) = \lambda_0 + \lambda_1 \cdot |\nabla\theta_4|$, with $\lambda_0 = 1.0$, $\lambda_1 = 10.0$.

Visualizations:
1. θ_4 contours identify the kink radius and energy localization band.
2. Mock τ fusion violation map shows suppression near kink ($r \approx r_0$).
3. $\lambda(x, y)$ peaks in the domain wall zone, enforcing τ fusion constraint.

Next Steps:
- Run full Metropolis annealing for τ dynamics under $\lambda(x, y)$.
- Enable optional θ_4 feedback update based on τ violations.
- Analyze domain alignment, defect localization, and fusion coherence.

Goal:
Determine whether τ domains preferentially bind to θ_4 kink regions, validating SAT composite structure dynamics.